CLAIMS

What is claimed is:

1. A switching rotator, comprising:

a switchable Faraday rotator;

a ferrite core surrounding the Faraday rotator; and

an electric coil surrounding the ferrite core, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the Faraday rotator.

2. The switching rotator of claim 1, wherein the switchable Faraday rotator comprises a saturation field of approximately less than 100 Oe.

3. The switching rotator of claim 1, wherein the switchable Faraday rotator is a latched rotator.

4. The switching rotator of claim 1, wherein the switchable Faraday rotator is a non-latched rotator.

5. The switching rotator of claim 1, wherein the switchable Faraday rotator comprises a Bi-substituted magnetic garnet.

6. A magnetooptic switch, comprising:

a polarization beam splitter (PBS) optically coupled to at least one input port, a first output port, and a second output port; a first and a second latched rotator optically coupled to the PBS at a side opposite to the at least one input port, the first output port, and the second output port;

a switching rotator optically coupled to the first and second latched rotators at a side opposite to the PBS, wherein the switching rotator comprises:

a switchable Faraday rotator optically coupled to the first and second latched rotators,

a ferrite core surrounding the Faraday rotator, and

an electric coil surrounding the ferrite core, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the Faraday rotator;

a Wollaston prism optically coupled to the Faraday rotator of the switching rotator at a side opposite to the first and second latched rotators; and

a reflector optically coupled to the Wollaston prism at a side opposite to the switching rotator, wherein the reflector reflects light back through the Wollaston prism, the switching rotator, the first and second latched rotators, and the PBS, wherein the reflected light is received either by the first output port or the second output port as determined by the direction of the current supplied to the electric coil.

7. The switch of claim 6, wherein positions of the first and second latched rotators and the switching rotator is interchangeable.

8. The switch of claim 6, wherein with light traversing through the switch in a forward direction, the PBS receives an unpolarized light from the at least one input port, wherein the PBS splits the unpolarized light into a first sub-beam with a first polarization direction and a second sub-beam with a second polarization direction.

9. The switch of claim 8, wherein with light traversing through the switch in a reverse direction, the PBS receives the first sub-beam from the first latched rotator and the second sub-beam from the second latched rotator, wherein the PBS combines the first and second sub-beams into the unpolarized light, wherein the unpolarized light traverses the PBS to either the first output port or the second output port as determined by the direction of the current supplied to the electric coil.

10. The switch of claim 9, wherein for light traversing through the switch in a forward direction, the first latched rotator receives the first sub-beam from the PBS, wherein the first latched rotator rotates the polarization direction of the first sub-beam in a first direction.

11. The switch of claim 10, wherein for light traversing through the switch in a reverse direction, the first latched rotator receives the first sub-beam from the switching rotator, wherein the first latched rotator rotates the polarization direction of the first sub-beam in the first direction.

12. The switch of claim 9, wherein for light traversing through the switch in a forward direction, the second latched rotator receives the second sub-beam from the PBS,

wherein the second latched rotator rotates the polarization direction of the second sub-beam in a second direction.

13. The switch of claim 12, wherein for light traversing through the switch in a reverse direction, the second latched rotator receives the second sub-beam from the switching rotator, wherein the second latched rotator rotates the polarization direction of the second sub-beam in the second direction.

14. The switch of claim 9, wherein for a first direction of the current, the switching rotator rotates the polarization directions of the first and second sub-beams in a first direction,

wherein for a second direction of the current, the switching rotator rotates the polarization directions of the first and second sub-beams in a second direction.

15. The switch of claim 9, wherein the Wollaston prism receives the first and second sub-beams, wherein the Wollaston prism displaces the first and second sub-beams.

16. The switch of claim 9, further comprising a third latched rotator optically coupled to the PBS at a side opposite to the at least one input port, the first output port, and the second output port.

17. The switch of claim 16, wherein for light traversing through the switch in a forward direction,

the first latched rotator receives the first sub-beam from the PBS, wherein the first latched rotator rotates the polarization direction of the first sub-beam in the second direction, and

the second latched rotator receives the second sub-beam from the PBS, wherein the second latched rotator rotates the polarization direction of the second sub-beam in the first direction.

18. The switch of claim 17, wherein for light traversing through the switch in a reverse direction,

the second latched rotator receives the first sub-beam from the switching rotator, wherein the second latched rotator rotates the polarization direction of the first sub-beam in the first direction, and

the third latched rotator receives the second sub-beam from the switching rotator, wherein the third latched rotator rotates the polarization direction of the second sub-beam in the second direction.

19. A magnetooptic switch, comprising:

a polarization beam splitter (PBS) optically coupled to at least one input port, a first output port, and a second output port;

a first, a second, and a third latched rotator optically coupled to the PBS at a side opposite to the at least one input port, the first output port, and the second output port;

a switching rotator optically coupled to the first, second, and third latched rotators at a side opposite to the PBS, wherein the switching rotator comprises:

a Faraday rotator optically coupled to the first, second, and third latched rotators,

a ferrite core surrounding the Faraday rotator, and

an electric coil surrounding the ferrite core, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the Faraday rotator;

a Wollaston prism optically coupled to the switching rotator at a side opposite to the first, second, and third latched rotators; and

a reflector optically coupled to the Wollaston prism at a side opposite to the switching rotator, wherein the reflector reflects light back through the Wollaston prism, the switching rotator, the second and third latched rotators, and the PBS, wherein the reflected light is received either by the first output port or the second output port as determined by the direction of the current supplied to the electric coil.

20. The switch of claim 19, wherein with light traversing through the switch in a forward direction, the PBS receives an unpolarized light from the at least one input port, wherein the PBS splits the unpolarized light into a first sub-beam with a first polarization direction and a second sub-beam with a second polarization direction.

21. The switch of claim 20, wherein with light traversing through the switch in a reverse direction, the PBS receives the first sub-beam from the third latched rotator and the second sub-beam from the second latched rotator, wherein the PBS combines the first and second sub-beams into the unpolarized light, wherein the unpolarized light

traverses the PBS to either the first output port or the second output port as determined by the direction of the current supplied to the electric coil.

22. The switch of claim 21, wherein for light traversing through the switch in a forward direction,

the first latched rotator receives the first sub-beam from the PBS, wherein the first latched rotator rotates the polarization direction of the first sub-beam in a second direction, and

the second latched rotator receives the second sub-beam from the PBS, wherein the second latched rotator rotates the polarization direction of the second sub-beam in a first direction.

23. The switch of claim 21, wherein for light traversing through the switch in a reverse direction,

the second latched rotator receives the first sub-beam from the switching rotator, wherein the second latched rotator rotates the polarization direction of the first sub-beam in a first direction, and

the third latched rotator receives the second sub-beam from the switching rotator, wherein the third latched rotator rotates the polarization direction of the second sub-beam in a second direction.

24. The switch of claim 21, wherein for a first direction of the current, the switching rotator rotates the polarization directions of the first and second sub-beams in a first direction,

wherein for a second direction of the current, the switching rotator rotates the polarization directions of the first and second sub-beams in a second direction.

25. The switch of claim 21, wherein the Wollaston prism receives the first and second sub-beams, wherein the Wollaston prism displaces the first and second sub-beams.

26. A magnetooptic switch, comprising:

a first polarization beam splitter (PBS) optically coupled to a first input port and a second input port;

a first latched rotator optically coupled to the PBS at a side opposite to the first and second input ports, wherein the first latched rotator receives at least one of a plurality of sub-beams from the PBS;

a first Wollaston prism optically coupled to the PBS and optically coupled to the first rotator at a side opposite to the first PBS;

a second latched rotator optically coupled to the first Wollaston prism at a side opposite to the first PBS;

a switching rotator optically coupled to the first Wollaston prism at a side opposite to the second latched rotator, wherein the switching rotator comprises:

a Faraday rotator optically coupled to the second latched rotator,

a ferrite core surrounding the Faraday rotator, and

an electric coil surrounding the ferrite core, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the Faraday rotator;

a second Wollaston prism optically coupled to the Faraday rotator of the switching rotator at a side opposite to the second latched rotator;

a third latched rotator optically coupled to the second Wollaston prism at a side opposite to the Faraday rotator;

a second PBS optically coupled to the third latched rotator and the second Wollaston prism; and

a first and a second output port optically coupled to the second PBS at a side opposite to the third latched rotator.

27. The switch of claim 26, wherein the first PBS received a first unpolarized light from the first input port and a second unpolarized light from the second input port,

wherein the first PBS splits the first unpolarized light into a first sub-beam with a first polarization direction and a second sub-beam with a second polarization direction,

wherein the first PBS splits the second unpolarized light into a third sub-beam with the first polarization direction and a fourth sub-beam with the second polarization direction.

28. The switch of claim 27, wherein the first latched rotator receives the second and third sub-beams from the PBS, wherein the first latched rotator rotates the polarization directions of the second and third sub-beams in a first direction.

29. The switch of claim 27, wherein the first Wollaston prism receives the first and fourth sub-beams from the first PBS and the second and third sub-beams from

the first latched rotator, wherein the first Wollaston prism displaces the first, second, third, and fourth sub-beams.

30. The switch of claim 27, wherein the second latched rotator receives the first, second, third, and fourth sub-beams from the first Wollaston prism, wherein the second latched rotator rotates the polarization directions of the first, second, third, and fourth sub-beams in a second direction.

31. The switch of claim 27, wherein the switching rotator receives the first, second, third, and fourth sub-beams from the second latched rotator,

wherein for a first direction of the current supplied to the electric coil, the switching rotator rotates the polarization directions of the first, second, third and fourth sub-beams in a first direction,

wherein for a second direction of the current supplied to the electric coil, the switching rotator rotates the polarization directions of the first, second, third, and fourth sub-beams in a second direction.

32. The switch of claim 27, wherein the second Wollaston prism receives the first, second, third, and fourth sub-beams from the switching rotator, wherein the second prism displaces the first, second, third, and fourth sub-beams.

33. The switch of claim 27, wherein the third rotator receives the first and fourth sub-beams from the second Wollaston prism, wherein the third rotator rotates the polarization directions of the first and fourth sub-beams in a first direction.

34. The switch of claim 27, wherein the second PBS receives the first and fourth sub-beams from the third rotator and the second and third sub-beams from the second Wollaston prism,

wherein the second PBS combines the first and second sub-beams, wherein the combined first and second sub-beams traverse to the first or the second output port based on the direction of the current supplied to the electric coil,

wherein the second PBS combines the third and fourth sub-beams, wherein the combined third and fourth sub-beams traverse to the second or the first output port based on the direction of the current supplied to the electric coil.

35. The switch of claim 26, wherein the first latched rotator rotates a polarization of a polarized light by approximately 90 degrees.

36. The switch of claim 26, wherein the first latched rotator comprises a thick Faraday rotator.

37. The switch of claim 26, wherein the first latched rotator comprises a half wave plate.

38. The switch of claim 26, wherein the second latched rotator rotates a polarization of a polarized light by approximately 45 degrees.

39. The switch of claim 26, wherein the second latched rotator comprise a Faraday rotator.

40. The switch of claim 26, wherein positions of the second latched rotator and the switching rotator is interchangeable.

41. The switch of claim 26, wherein the third latched rotator rotates a polarized light by approximately 90 degrees.

42. The switch of claim 26, wherein the third latched rotator comprises a thick Faraday rotator.

43. The switch of claim 26, wherein the third latched rotator comprises a half wave plate.

44. The switch of claim 27, wherein the first direction is counter close-wise.

45. The switch of claim 26, wherein the second direction is clockwise.

46. The switch of claim 26, wherein the switch is bi-directional, wherein the switch functions for lights traversing through the switch in a forward direction and a backward direction.

47. A magnetooptic switch, comprising:

a polarization beam splitter (PBS) optically coupled to an input port;

a first latched rotator optically coupled to the PBS;

a polarization walk-off optically coupled to the PBS and the first latched rotator; and

a switching rotator, comprising:

a second latched rotator optically coupled to the polarization walk-off,

a switchable Faraday rotator optically coupled o the second latched rotator,

a ferrite core surrounding the Faraday rotator,

an electric coil surrounding the ferrite coil, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the Faraday rotator, and

a reflection layer coupled to the Faraday rotator at a side opposite to the second latched rotator, wherein the reflection layer reflects light back through the Faraday rotator, the second latched rotator, the polarization walk-off, the first latched rotator, and the PBS, wherein the reflected light is received either by a first output port or a second output port as determined by the direction of the current supplied to the electric coil.

48. The switch of claim 47, wherein with light traversing through the switch in a forward direction, the PBS receives an unpolarized light from the input port, wherein the PBS splits the unpolarized light into a first sub-beam with a first polarization direction and a second sub-beam with a second polarization direction.

49. The switch of claim 48, wherein with light traversing through the switch in a reverse direction, the PBS receives the second sub-beam from the first latched rotator and the first sub-beam from the polarization walk-off, wherein the PBS combines the first and second sub-beams into the unpolarized light, wherein the unpolarized light traverses the PBS to either the first output port or the second output port as determined by the direction of the current supplied to the electric coil.

50. The switch of claim 48, wherein for light traversing through the switch in a forward direction, the first latched rotator receives the second sub-beam from the PBS, wherein the first latched rotator rotates the polarization direction of the second sub-beam in a first direction.

51. The switch of claim 50, wherein for light traversing through the switch in a reverse direction, the first latched rotator receives the second sub-beam from the polarization walk-off, wherein the first latched rotator rotates the polarization direction of the second sub-beam in the first direction.

52. The switch of claim 48, wherein the polarization walk-off receives the first and second sub-beams, wherein the polarization walk-off displaces the first and second sub-beams.

53. The switch of claim 48, wherein for a first direction of the current, the switching rotator rotates the polarization direction of the first and second sub-beams in a first direction,

wherein for a second direction of the current, the switching rotator rotates the polarization directions of the first and second sub-beams in a second direction.

54. The switch of claim 47, wherein the first latched rotator rotates a polarization of a polarized light by approximately 90 degrees.

55. The switch of claim 47, wherein the first latched rotator comprises a thick Faraday rotator.

56. The switch of claim 47, wherein the first latched rotator comprises a half wave plate.

57. The switch of claim 47, wherein the switch is bi-directional, wherein the switch functions for lights traversing through the switch in a forward and a backward direction.

58. A magnetooptic switch, comprising:

a cubic polarization beam splitter (PBS);

a first switching rotator optically coupled to a first face of the cubic PBS, the first switching rotator comprising:

a first latched rotator optically coupled to the first face of the cubic PBS,

a first switchable Faraday rotator optically coupled to the first latched rotator,

a first ferrite core surrounding the first switchable Faraday rotator,

a first electric coil surrounding the first ferrite coil, wherein a direction of a current supplied to the first electric coil determines a direction of rotation of a polarization of a light traversing through the first switchable Faraday rotator, and

a first reflection layer coupled to the first switchable Faraday rotator at a side opposite to the first latched rotator, wherein the first reflection layer reflects a first light back through the first Faraday rotator, the first latched rotator, and the cubic PBS, wherein the reflected first light is received either by a first output port or a second output port as determined by the direction of the current supplied to the first electric coil; and

a second switching rotator optically coupled to a second face of the cubic PBS adjacent to the first face, the second switching rotator comprising:

a second latched rotator optically coupled to the second face of the cubic PBS,

a second switchable Faraday rotator optically coupled to the second latched rotator,

a second ferrite core surrounding the second switchable Faraday rotator,

a second electric coil surrounding the second ferrite coil, wherein a direction of a current supplied to the second electric coil determines a direction of rotation of a polarization of a light traversing through the second switchable Faraday rotator, and

a second reflection layer coupled to the second switchable Faraday rotator at a side opposite to the second latched rotator, wherein the second reflection layer reflects a second light back through the second switchable Faraday rotator, the second latched rotator, and the cubic PBS, wherein the reflected second light is received either

by the second output port or the first output port as determined by the direction of the current supplied to the second electric coil.

59. A magnetooptic switch, comprising:

a special shaped polarization beam splitter (PBS); and

a switching rotator optically coupled to the special shaped PBS, the switching rotator comprising:

a latched rotator optically coupled to the special shaped PBS,

a switchable Faraday rotator optically coupled to the latched rotator,

a ferrite core surrounding the switchable Faraday rotator,

an electric coil surrounding the ferrite coil, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the switchable Faraday rotator, and

a reflection layer coupled to the switchable Faraday rotator at a side opposite to the latched rotator, wherein the reflection layer reflects light back through the switchable Faraday rotator, the latched rotator, and the special shaped PBS, wherein the reflected light is received either by a first output port or a second output port as determined by the direction of the current supplied to the electric coil.

60. A method for switching an unpolarized light, comprising the steps of:

(a) splitting the unpolarized light into a first sub-beam with a first polarization direction and a second sub-beam with a second polarization direction;

(b) rotating either the first or the second sub-beam, such that the polarization directions of the first and second sub-beams are parallel, wherein the rotating is performed by a switching rotator, wherein the switching rotator comprises:

a switchable Faraday rotator for rotating the polarization directions of the first and second sub-beams,

a ferrite core surrounding the switchable Faraday rotator, and

an electric coil surrounding the ferrite core, wherein a direction of a current supplied to the electric coil determines a direction of rotation of the polarization of the first and second sub-beams;

(c) displacing the first and second sub-beams;

(d) combining the first and second sub-beams in the unpolarized light; and

(e) outputting the unpolarized light either at a first output port or a second output port based upon the direction of the current supplied to the electric coil.

61. A system, comprising:

an optical network, the optical network comprising:

at least one input port for providing an optical signal with an arbitrary polarization,

a first output port, and

a second output port; and

a magnetooptic switch, comprising:

a PBS optically coupled to at least one input port,

a first and a second latched rotator optically coupled to the PBS at a side opposite to the at least one input,

a switching rotator optically coupled to the first and second latched rotators at a side opposite to the PBS, wherein the switching rotator comprises:

a switchable Faraday rotator optically coupled to the first and second latched rotators,

a ferrite core surrounding the switchable Faraday rotator, and

an electric coil surrounding the ferrite core, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the switchable Faraday rotator;

a Wollaston prism optically coupled to the switchable Faraday rotator of the switching rotator at a side opposite to the first and second latched rotators, and

a reflector optically coupled to the Wollaston prism at a side opposite to the switching rotator, wherein the reflector reflects light back through the Wollaston prism, the switching rotator, the first and second latched rotators, and the PBS, wherein the reflected light is received either by the first output or the second output as determined by the direction of the current supplied to the electric coil.

62. A system, comprising:

a plurality of switches optically coupled to each other, wherein at least one of the plurality of switches comprises:

a PBS optically coupled to an input port,

a first and a second latched rotator optically coupled to the PBS at a side opposite to the input port,

a switching rotator optically coupled to the first and second latched rotators at a side opposite to the PBS, wherein the switching rotator comprises:

a switchable Faraday rotator optically coupled to the first and second latched rotators,

a ferrite core surrounding the switchable Faraday rotator, and

an electric coil surrounding the ferrite core, wherein a direction of a current supplied to the electric coil determines a direction of rotation of a polarization of a light traversing through the switchable Faraday rotator,

a Wollaston prism optically coupled to the switchable Faraday rotator of the switching rotator at a side opposite to the first and second latched rotators, and

a reflector optically coupled to the Wollaston prism at a side opposite to the switching rotator, wherein the reflector reflects light back through the Wollaston prism, the switching rotator, the first and second latched rotators, and the PBS, wherein the reflected light is received either by a first output or a second output as determined by the direction of the current supplied to the electric coil; and

an optical signal traversing through at least one of the plurality of switches.